



**University of  
Zurich**<sup>UZH</sup>

**Zurich Open Repository and  
Archive**

University of Zurich  
University Library  
Strickhofstrasse 39  
CH-8057 Zurich  
[www.zora.uzh.ch](http://www.zora.uzh.ch)

---

Year: 2012

---

## **Researching the future of pastoralism in central Asia's mountains: examining development orthodoxies**

Kerven, Carol ; Steimann, Bernd ; Dear, Chad ; Ashley, Laurie

**Abstract:** This paper synthesizes research findings on contemporary mountain pastoralism in Kyrgyzstan and Tajikistan, based on a longer review characterizing mountain agropastoralism in Central Asia. We focus here on the principal issues that have been emphasized over the past two decades in policy, programs, and projects regarding pastoralism in Central Asia's mountains. We conclude that this emphasis has largely been driven by two unproven orthodoxies about The extent and causes of pasture degradation; and The need for decentralization and pasture land privatization. The paper proposes that new research should critically assess these orthodoxies through more empirical and long-term field research. This will yield practical applications to improve conditions for Central Asian mountain pastoralists and their environment. Pursuing measures for addressing pasture degradation will require determinations of whether, where, how, and why degradation and desertification are occurring. Detailed field research is also called for on the processes and effects of decentralizing the power to allocate and manage pasture resources from national and regional state authorities to local communities, as well as on the long-term effects of privatizing pasture land.

DOI: <https://doi.org/10.1659/MRD-JOURNAL-D-12-00035.1>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-77928>

Journal Article

Published Version

Originally published at:

Kerven, Carol; Steimann, Bernd; Dear, Chad; Ashley, Laurie (2012). Researching the future of pastoralism in central Asia's mountains: examining development orthodoxies. *Mountain Research and Development*, 32(3):368-377.

DOI: <https://doi.org/10.1659/MRD-JOURNAL-D-12-00035.1>

## **Researching the Future of Pastoralism in Central Asia's Mountains: Examining Development Orthodoxies**

Author(s): Carol Kerven, Bernd Steimann, Chad Dear, and Laurie Ashley

Source: Mountain Research and Development, 32(3):368-377. 2012.

Published By: International Mountain Society

DOI: <http://dx.doi.org/10.1659/MRD-JOURNAL-D-12-00035.1>

URL: <http://www.bioone.org/doi/full/10.1659/MRD-JOURNAL-D-12-00035.1>

---

BioOne ([www.bioone.org](http://www.bioone.org)) is a nonprofit, online aggregation of core research in the biological, ecological, and environmental sciences. BioOne provides a sustainable online platform for over 170 journals and books published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/page/terms\\_of\\_use](http://www.bioone.org/page/terms_of_use).

Usage of BioOne content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

# Researching the Future of Pastoralism in Central Asia's Mountains: Examining Development Orthodoxies

Carol Kerven<sup>1\*</sup>, Bernd Steimann<sup>2</sup>, Chad Dear<sup>3</sup>, and Laurie Ashley<sup>4</sup>

\* Corresponding author: carol\_kerven@msn.com

<sup>1</sup> Odessa Centre, Great Wolford, Warwickshire CV36 5NN, United Kingdom

<sup>2</sup> HELVETAS Swiss Intercooperation, Switzerland

<sup>3</sup> Mountain Societies Research Centre, University of Central Asia, Bishkek, Kyrgyzstan

<sup>4</sup> Aga Khan Foundation, Bishkek, Kyrgyzstan

Open access article: please credit the authors and the full source.

*This paper synthesizes research findings on contemporary mountain pastoralism in Kyrgyzstan and Tajikistan, based on a longer review characterizing mountain agropastoralism in Central Asia. We focus here on the principal issues that have been emphasized over the past two decades in policy, programs, and projects regarding pastoralism in Central Asia's mountains. We conclude that this emphasis has largely been driven by two unproven orthodoxies about*

- *The extent and causes of pasture degradation; and*
- *The need for decentralization and pasture land privatization.*

*The paper proposes that new research should critically assess these orthodoxies through more empirical and long-term field research. This will yield practical applications to improve conditions for Central Asian mountain pastoralists and their environment. Pursuing measures for addressing pasture degradation will require determinations of whether, where, how, and why degradation and desertification are occurring. Detailed field research is also called for on the processes and effects of decentralizing the power to allocate and manage pasture resources from national and regional state authorities to local communities, as well as on the long-term effects of privatizing pasture land.*

**Keywords:** Research agenda; pastoralism; former Soviet Union; Central Asia; Kyrgyzstan; Tajikistan.

**Reviewed by the editors:**  
May 2012

**Accepted:** June 2012

## Introduction

Societies living in mountainous areas of Central Asia face particular adversities as a result of the geopolitical and economic conditions of post-Soviet states. Current adaptations by mountain societies were reviewed in an extensive report on pastoralism and farming in Central Asian mountains (Kerven et al 2011). The present paper is a shortened and partial synthesis of that review, aimed at two notable themes that emerged from our overview of research on Central Asian mountain agropastoralism over the past 20 years. These themes are (1) pasture degradation and (2) promoting participatory approaches to communal pasture management.

This paper considers only mountain pastoralism in Kyrgyzstan and Tajikistan, where we found that the bulk of relevant studies have been conducted. We have not sought to cover all variables that affect the lives of mountain pastoralists in Central Asia (eg the role of religion and ancient cultural beliefs). We propose an agenda for biophysical and socioeconomic research on mountain pastoralism in Central Asia.

## Old and new research directions

The emphasis of research has radically changed since the end of the Soviet period in 1991. Contemporary studies of pastoralists and the context of pastoralism in Central Asia have moved far from the

practical concerns of Soviet social and biological scientists. Scientists in the USSR were looking long and hard at the ground, the plants, and the animals. Directed by state planning committees, their obligation was to increase and stabilize production output within a strict ideological parameter of development.

In contrast, much post-Soviet research on agricultural production systems in Central Asia is rooted in Western development models, activated through international (mostly Western) funding channels that support short-term research and development programs, and variously aimed at bolstering civil society, biodiversity conservation, sustainable land management, and market value chains. The post-Soviet swing in emphasis has meant less basic biological research and few rigorous investigations regarding the present-day status of Central Asian mountain pastoralism. At the same time, the quality and funding of national research institutions has eroded throughout the transition period since 1991 (Kerven et al 1996).

There is, however, a considerable body of documentation—in development project reports and in Russian-language scholarly works—on ethnohistory, livestock breeding, pasture vegetation and soils, and other specialized fields relevant to understanding Central Asian mountain pastoralism. We do not summarize Soviet-era research on this topic, though this is recommended for a more complete

**TABLE 1** Mountain pasture area in 1975 and percentage in 2009.

Countries	Total permanent meadows and pastures in 2009* (km <sup>2</sup> )	Percent pastures of total agricultural land	Natural mountain pastures in 1975** (km <sup>2</sup> )	Percent mountain pastures of total pastureland in 2009*
Kyrgyzstan	92,663	87%	88,168	94%
Tajikistan	38,750	82%	33,479	86%

Sources: \*FAO 2011; \*\*Mamytov 1987.

understanding of the basic issues (Kerven et al 1996).

### Characterizing mountain pastoralism and transhumance in Central Asia

Most of Central Asia has a semiarid or arid climate. Thus, the mountains are attractive to pastoralists because they usually receive more precipitation than the plains and valleys (Mamytov 1987; Russian Nature 2011). The natural mountain vegetation offers alternative nutritional qualities for livestock (Kerven 2003). Slopes can be used to build gravity-fed irrigation channels to water food and fodder crops. Springs and streams provide water to people and livestock. The cooler mountain climate in summer means a more pleasant environment for people and their livestock.

But there are also severe drawbacks to making a living on mountain land in Central Asia. Higher levels of precipitation result in deep snowfalls in winter, which can cut off villages for long periods. Some livestock breeds cannot forage under deep snow and are not physiologically equipped to cope with intense cold periods. At higher altitudes, the short frost-free period results in a limited growing season for food and fodder crops, as well as natural pasture (Khukmatullo et al 2005). Transport is impeded by steep and dangerous terrain, and routes may be blocked by avalanches and rock falls. Remoteness and inaccessibility can lead to social isolation, as well as political and economic marginalization, as discussed later in this paper.

Given the attractions and disadvantages of mountains for making a living, from prehistoric times in Central Asia, people adopted the practice of transhumance: They spend part of each year with livestock in the mountains, when environmental conditions are optimal, and the rest of each year somewhere else—in adjacent lower valleys, distant plains, or even cities (van Leeuwen et al 1994).

Natural pastures—that is, unimproved by planted species or techniques—constitute the principal land area in the two countries, where mountain pastures are by far the greatest source of livestock forage (Table 1). Mountain pastoralism is a significant contributor to the gross domestic product in Kyrgyzstan and Tajikistan (Peyrouse 2009: 5).

Most pastures are located at altitudes between 1000 and 3500 masl, in intermontane valleys and mountain slopes, while one quarter are found at elevations greater than 3500 masl. Climatic conditions therefore differ according to slopes with different aspects, enclosed basins, and exposed plateaus (Russian Nature 2011; Sedik 2009). Annual precipitation varies from more than 1500 mm in the Gissar Range of Tajikistan to less than 100 mm in the Eastern Pamir (Khukmatullo et al 2005; Conservation International 2012). Much precipitation falls as snow in autumn, winter, and spring. Snowmelt in summer provides drinking water for humans and livestock, and for crop irrigation, in environments that are otherwise often very dry.

The mountains of Central Asia are a biodiversity hotspot, containing two major mountain ranges, the Pamir and the Tien Shan, characterized by exceptional levels of plant endemism and, it is claimed, by serious habitat loss (Conservation International 2012). There are many unresolved conflicts of interest among mountain villagers, foreign and national wildlife hunters, national wildlife conservation policies, and international conservationists in the region (Lüthi 2003; Undeland 2005; Haslinger et al 2007). The mountains also contain indigenous domesticated livestock breeds, eg cashmere goats, that are a valuable and endangered genetic resource (Kerven et al 2009).

### Pasture degradation

Degradation of land has been the predominant issue for many researchers and development agencies concerned with mountain regions of these two countries. This is evidenced by the proportion of reports and projects on the subject, noted in our review (Kerven et al 2011). Pasture degradation—its definition, causes, effects, extent, and amelioration—was also the most debated topic at the Bishkek Symposium titled “Pastoralism in Central Asia: Status, Challenges, and Opportunities in Mountain Areas” in June 2011.

The concept of degradation and its particular applicability to Central Asian mountain pastures is not simple. There are multiple and nonstandard criteria of degradation regarding pastures (Briske et al 2005). The initial problem is to decide what

is to be measured (Behnke and Scoones 1993). A few examples are loss of plant and wild animal diversity from some previous measured state, retreat from botanical climax, rise in toxic and unpalatable plants to livestock, loss of topsoil and humus, increasing bare ground with no vegetation cover, and permanent loss of an economic good, in this case an irreversible decline in livestock production. Botanists, range ecologists, socioeconomists, pasture agronomists, livestock production specialists, and agricultural policy-makers are unlikely to all agree on the critical indices of degradation.

In the last decades of Soviet planning for agriculture, Central Asian pasture scientists steadily and insistently challenged the orthodoxy that humans could always conquer nature by intensifying production and relentlessly increasing livestock output on the pastures (Kerven et al 1996; Alimaev and Behnke 2008). They pointed out the ecological ceilings that, if surpassed, resulted in critical environmental damage and loss of economic productivity and warned against greater development of irrigated fodder and food crops on steep mountain slopes (Mamytov 1987; Zotov and Adenov 1992). Since the 1990s, this early warning has expanded into a crescendo of concern by international donors and nongovernmental organizations (NGOs).

But in less than 1 decade after 1991, the entire Soviet mode of production in Central Asian pastoral regions was destroyed, and livestock numbers plummeted (Kerven 2003; Pomfret 2006), leaving the locus, causes, and degree of pasture degradation all radically altered (Coughenour et al 2008). Meanwhile, the ability of most private pastoralists to invest in alternative pasture management methods has been severely limited.

To date, studies in the region have indicated determinants of pasture degradation that are fundamentally different from the damage to land caused by the high input and

overstocked Soviet pasture management systems. The multiple and interacting drivers of pasture degradation in the mountains of Kyrgyzstan and Tajikistan are now said to be

- Reduction of livestock mobility in terms of distances moved and the number of times per year that animals are taken to pastures in different locations;
- Reduction in affordable and good-quality supplementary winter feed (cultivated or natural hay);
- Poverty of many livestock owners, preventing their investment in improved livestock feeding technology and the hiring of shepherds;
- Changes in livestock species kept, which have different forage requirements and thus different impacts on the pastures;
- Rural labor outmigration to cities, reducing available rural labor for herding livestock on distant pastures and increasing the workload on women in managing livestock;
- Changes in pasture tenure regulations and de facto use, resulting in poorer people's livestock having limited access to better-quality pastures surrounding key resources, as well as allowing richer people to claim better pastures; and
- Global climate changes, leading to warming tendencies and changes in precipitation amount and timing in the region's mountains.

The following sections summarize the literature on these drivers.

#### **Reduction of livestock seasonal mobility**

Seasonal transhumance among plains, mountain valleys, and distant upper meadows has been greatly reduced in the post-Soviet period (Rahim and Maselli 2008; Robinson and Whitton 2010). Following dissolution of the state livestock farms ending state-controlled pasture use, pastures farther from mountain settlements have become underutilized, while the more accessible pasture areas are

overutilized. This is reported for Kyrgyzstan by Schillhorn van Veen (1995), Ludi (2004), Farrington (2005), and Undeland (2005). In Tajikistan, studies show uneven seasonal grazing utilization over space (Domeisen 2002; Hangartner 2002; Haslinger et al 2007; Sedik 2009; Wirz 2009; Vanselow 2011). Grazing pressure is particularly severe during winter, and poorer households are obliged to graze their livestock continuously around villages and to destock. Efficient seasonal utilization of remote pastures requires expensive transport by vehicle and additional labor (either family or hired; Figure 1); moving livestock to remote pastures has therefore become an option mainly for richer households (Hangartner 2002; Farrington 2005).

#### **Livestock feed shortages**

By the later Soviet period of planned livestock production, state investments in irrigation, mechanized transport, and other infrastructure permitted heavier livestock pressure on pastures, making livestock reliant on plentiful and highly nutritious winter feed (Schillhorn van Veen 1995; Fitzherbert 2000; Ludi 2004).

In the early 1990s, fodder yields collapsed in both countries due to the privatization of arable land and the lack of cash investment, fertilizers, and working machinery. In the mountain areas, arable land is usually scarce and nowadays not irrigated; in the Soviet era, it was used for fodder cultivation or as hay land. Most rural households now, however, use irrigated mountain land to cultivate potatoes and vegetables for their subsistence needs (Eriksson 2006; Ronsijn 2006; Akramov and Omuraliev 2009). Furthermore, labor migration has led to abandonment of some arable land (Wolffgramm et al 2010), with consequent decline in availability of fodder crops, residues, and hay stored for winter. Cessation of concentrate imports from other former Soviet republics further



**FIGURE 1** Hired shepherds in summer pastures, Surkhob valley, Tajikistan. (Photo by Carol Kerven)



worsened this winter feed scarcity (Fitzherbert 2000). The inefficient processing and storage of hay also aggravates the winter feed scarcity (Figure 2), with estimates that this leads to a loss of energy and nutrients of up to 40% (World Bank 2007).

#### **Poverty of privatized livestock owners**

Grazing and feeding livestock requires inputs of cash and labor, in addition to suitable land. When these are in short supply due to poverty, livestock owners must still try to keep their few livestock alive and reproducing. They do this by feeding them whatever is available, wherever they find it, and at the lowest cost. This has been one of the principal reasons more accessible pastures were overgrazed in the post-Soviet period (Kerven et al 2006, 2008).

The consequences for livestock of poor nutrition over winter are higher adult mortality, lower fertility and birth rates, and increased risk of disease. For mountain households that cannot afford to obtain sufficient quality and quantity of winter feed, this leads to a cycle of

poverty, because their flocks and herds cannot grow due to low reproductive rates and more animals must be sold to support the remaining few (AKF 2004, 2005, 2006).

Many mountain households fail to enter rural commodity markets and to move beyond subsistence production. Emergence of secure and profitable value chains for livestock products is hampered due to remoteness, poor raw material quality, absence of disease controls, and insufficient price information (Ajibekov 2005; Näscher 2009; Steimann 2011). In Kyrgyzstan, a large share of rural households depends on small amounts of state welfare eg child allowances and old-age pensions. There is also increasing loss of mutual trust and aid among rural households, a further cause of impoverishment (Kuehnast and Dudwick 2004; Farrington 2005; Sabates-Wheeler 2007; Steimann 2011).

#### **Changes in livestock species kept**

Each species of livestock has specific impacts on pastureland through

their foraging habits and preferences for different palatable vegetation species. The species composition of livestock has changed considerably in the past 20 years (Table 2). In 1991, Kyrgyzstan's mountains contained 2.5 to 3 times the number of sheep that are now kept. However, the number of goats in private flocks has more than doubled (FAO 2011, 2012). In Tajikistan, there has likewise been a great increase in the recorded number of goats, but unlike Kyrgyzstan, the numbers of sheep have risen slightly, again after a steep decline in the 1990s (FAO 2011, 2012). The rise in goat numbers relative to the other livestock species is related to the impoverishment of mountain villagers. Goats compared to sheep are more prolific, cost less to buy, and are easier to herd in these hilly environments (Kerven et al 2009). All these factors have made goats more attractive for poorer households. Local government authorities in these countries comment that they are worried that the increase in goats may be causing pasture degradation

**FIGURE 2** Hay harvesting, Naryn, Kyrgyzstan. (Photo by Bernd Steimann)



through overgrazing. However, no field research has been conducted in this region to test the impacts on pastureland of the rising goat numbers versus sheep and cattle.

#### **Rural outmigration and lack of herding labor**

The lack of economic opportunity in these mountain areas has led to massive, mostly male, outmigration to national urban centers and to international destinations, mainly southern Kazakhstan and Russia (Olimova and Bosc 2003; Macours and Swinnen 2005; Jones et al 2007; Schmidt and Sagynbekova 2008; Schoch 2008; Schoch et al 2010). Remittances sent back by migrants are often used to build up flocks, to compensate the loss of domestic workforce by hiring local labor, or both. Outmigration is increasing the

burden of women to manage livestock and pasture-related economic practices, with their greater domestic workload when their husbands and sons migrate to work elsewhere (Kanji 2002; Thieme 2008; Figure 3). The shortage of adult men has increased the cost for shepherding livestock farther from settlements. There is also a constant increase of livestock numbers partially financed through remittances (Eggenberger 2011). These changes may be aggravating the pressure on pastures around settlements that is already occurring due to other factors discussed here.

#### **Changes in pasture tenure regulations**

There has been a fundamental shift in the legal forms by which pastures are held. The application of new

pasture tenure laws has had considerable effects on how pastures are used and thus the potential for overuse. In Kyrgyzstan, legal changes instituted in 2002 based pasture use on territorial leases, to be obtained by individuals or groups from local administrations (Undeland 2005; Liechti 2008). The pasture lease system was complicated and had the unintended effect of creating generalized open access of pastures. This led to overuse of more accessible pastures, as less wealthy villagers were effectively excluded from more desirable but more remote pastures (Jones 2003; Lerman and Sedik 2009; Steimann 2011).

In 2009, a new law in Kyrgyzstan abandoned the lease system and instead transferred all administrative authority over pastures to so-called grazing committees at the local

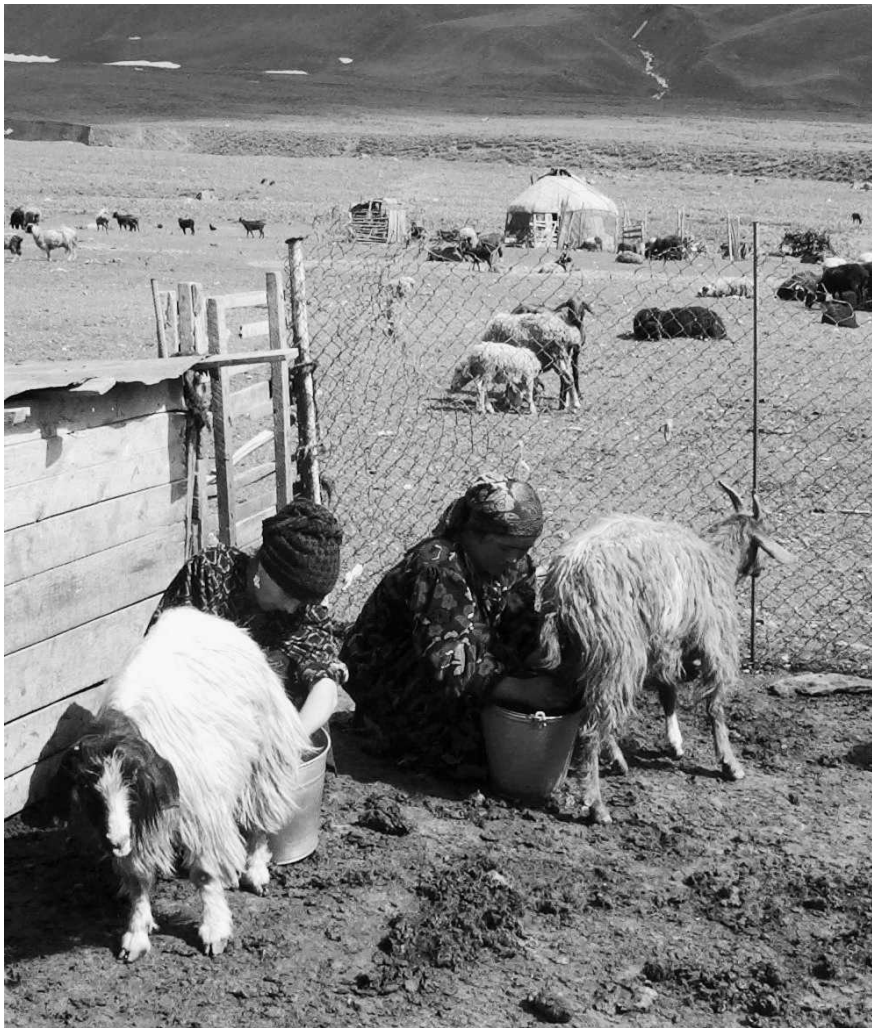
**TABLE 2** Changes in livestock populations in Kyrgyzstan and Tajikistan, 1992–2009.

Livestock type	Kyrgyzstan heads × 1000		% change	Tajikistan heads × 1000		% change
	1992	2009		1992	2009	
Cattle	1190	1224	+13%	1390	1800	+13%
Sheep	9225	3606	–256%	2484	2578	+30%
Goats	300	897	+290%	870	1568	+180%

Source: FAO 2011.



**FIGURE 3** Pastoral women milking goats, Surkhob Valley, Tajikistan. (Photo by Carol Kerven)



community level. However, comparatively wealthy and well-connected households can often afford to secure *de facto* exclusive access to a large pasture area through the construction of a barn on the winter or spring-autumn pastures (Steimann 2011). Such informal—yet not illegal—exclusion from formerly common property grazing areas can lead to further grazing pressure on the residual grazing areas that remain open access and unclaimed.

Similarly, in Tajikistan individuals can obtain use rights to pastures through negotiation with the state administration at a district level (Peyrouse 2009; Sedik 2009; Rowe 2010). The current legislation is

unclear about when and how pastures may be privatized or leased by individuals. Large herd owners increasingly tend to privatize remote seasonal pastures, while smaller owners lose access to these pastures and are eventually forced to overgraze other, more accessible areas (Ludi 2003; Robinson and Whitton 2010).

#### **Climate change and pasture degradation**

Climate change trends and projections in Central Asia could have important implications for future pasture degradation. Annual average temperatures are steadily rising in Kyrgyzstan and Tajikistan at

a rate similar to or greater than average global temperature rise (Aizen et al 1997; Giese et al 2007; Savitskaya 2010). Projections for mountain areas are difficult because of the inherent climate variability of mountains. Climate model projections for Central Asia, however, include warming much greater than the global mean (3.7°C by 2100 compared to an 3°C globally), maximum warming in summer months, and a greater temperature increase in high-elevation areas (Christensen et al 2007).

Pasture productivity, hay fields, and fodder crops are strongly influenced by climate conditions. The 2007 International Panel on Climate Change report concludes with a high level of confidence that Central Asia is very vulnerable (highest rating) to land degradation from climate change impacts (Cruz et al 2007). Research from Kyrgyzstan and Tajikistan concludes that drying associated with higher air temperatures could cause a significant reduction in the productivity of certain pastures (GoTJ 2008; GoKR 2009). While warming temperatures will result in a longer growing season that may benefit certain pasture plants and fodder crops, increased drying and precipitation variability (including drought) are likely to negatively affect pastures in particular (Tebaldi et al 2006). Climate change projections for warmer and drier summers are significant for agriculture, yet extreme climate events are equally or more important factors (Lioubimtseva and Henebry 2009). Livestock production is particularly sensitive to drought, while aridity is already a limiting factor in much of this region (Lioubimtseva and Henebry 2009).

#### **Conclusions and research priorities**

The most prominent research and development topics on Central Asian



pastoral regions over the last two decades have been pasture management and mismanagement and, linked to this, land degradation (Kerven et al 2011). Much money has been spent by international donors, the United Nations, and international NGOs on short-term research and projects to improve pasture management. However, many of the reports we reviewed were superficial, derivative, and nonempirical. Nevertheless, they have been influential in attracting still more donor funds to combat “degradation.” Our first conclusion is that further research is needed to confront and test these “environmental orthodoxies”:

*A great amount of “development policy” has often been driven by simplistic, and even scientifically unsupported, assumptions, [for example] the collection of environmental orthodoxies embedded in the “Theory of Himalayan Environmental Degradation.” The sheer simplicity and intellectual attractiveness of this particular orthodoxy has ensured its survival despite its effective scholarly rejection. (Ives 2001: 132–144)*

The promulgation of environmental orthodoxies suggests there may be a political economy of “degradation discourse” arising from the intertwined interests of researchers, NGOs, donors, and governments. Such a discourse can create incentives for researchers and research organizations to disseminate scare stories about the disastrous conditions of the land (and now the climate) that provide governments with justification to press for certain changes and additional funding. One of the difficulties for researchers is to be objective and independent yet obtain funding.

Donor and national government-supported projects have attempted all kinds of pasture management schemes, convinced that they were needed to halt degradation and desertification and to improve

pasture productivity. (For a few examples, see World Bank 2003, 2007; CARNET 2005; UNDP 2007; Ji 2008; UNDP and GEF 2008; ADB 2009; ADB 2010; UNEP 2011; UNU-EHS 2012.) Nevertheless, conclusions about whether, where, how, and why degradation and desertification are occurring, and what methods could be used to tackle these processes, have been based less on updated field-based evidence and more on untested orthodoxy. “Overgrazing” or “overstocking” is often cited in these reports as causing land degradation. But new field studies assessing the causes, effects, characteristics, and implications of grazing and pasture degradation in Central Asian mountains are applying careful measurements that raise questions about any simple correlation of overgrazing and land degradation (Bimüller et al 2010).

The first research priority is to inventory the impact of the many pasture development projects and new pasture tenure legislation in the mountains. What was the uptake of the various pasture improvement methods demonstrated and advocated? Did mountain villagers who depend on the pastures apply these methods, and did the villagers obtain project results that were useful to them? What were the results? Are the benefits replicable without external technical funds and assistance? Who benefitted? What were the costs? Who bore the costs?

A second research priority is to assess the scientific basis for the interventions proposed and promoted to the pasture users. One reliable assessment of the reported findings is whether they refer to research results published in scientific, peer-reviewed international sources. A check through the bibliographic search engine Web of Science reveals that since the late 1980s there have been no scientific articles published with new data on pasture degradation in Tajikistan and only one article on effects of deforestation on soils in

Kyrgyzstan. The same pattern is found by searching Google Scholar.

The reports about pasture mismanagement, degradation, and the need for rehabilitation in Kyrgyzstan and Tajikistan often repeat previous assumptions and preconceptions, usually without offering fresh data. There is a clear need to do more in-depth field work, followed by modeling, on the multiple interacting causes and feedback effects of changes in the soil, vegetation, climate, and animal populations—both livestock and wildlife—to understand the biophysical impacts of the profound changes in land management over the past 20 years.

Only when we have new and reliable data will we be able to say whether any practical measures can be taken to improve pasture management and still benefit the land users. Without sound data that tests the current assumptions, there is a risk that land users—farmers and pastoralists—will continue to be blamed for despoiling the land through bad management. This can provide a rationale for governments and their donor supporters to redistribute land through privatization, as is occurring in Tajikistan with World Bank support, or to exclude pastoralists from their land on the justification that this helps conserve vegetation cover, soil, biodiversity, river headwaters, etc, as is being implemented by the Chinese government in the mountainous pastoral regions neighboring Central Asia (Harris 2010; Xinchun 2011).

### **Community participatory pasture management**

Another set of research priorities stems from the current policy trend to decentralize pasture management from the national to the local level to make it more “participatory.” In Kyrgyzstan, the World Bank’s efforts to establish standardized communal pasture user committees seem to be influenced by rather simplistic ideas.

Jacquesson (2010) argues that this new Kyrgyz pasture law rests on the longstanding misconceptions of “clan,” “custom,” and “tradition” as social institutions that would allow for a level playing field, thus ignoring the often unequal relations among local herders. After 1991, romanticized notions invoking “nomadic traditions” have become increasingly popular, not least because they have been politically useful to the government of Kyrgyzstan. Empirical evidence shows, however, that nowadays the mountain pastoral communities are anything but homogenous and are instead characterized by striking disparities in terms of wealth and power. Consequently, we would welcome more mutual exchange among donor agencies, development practitioners, and researchers, requiring a critical dialogue about assumptions and priorities and long-term scientific monitoring of the implementation and effects of particular development interventions. Unfortunately, though, development projects often operate with a much shorter time horizon than field research projects.

The towering mountains of Central Asia hold a great appeal to certain people—among others, geologists, botanists, wildlife biologists, conservationists, anthropologists, hikers, bikers, ecotourists, development workers, glaciologists, geographers, climatologists, and livestock scientists. But after the researchers, development agents, and tourists have come and gone, the mountain dwellers remain. They deserve a long-term commitment to understanding their problems and assisting with their efforts to find solutions.

## ACKNOWLEDGMENTS

The authors thank Emanuele Costa and Kishvar Pallae at the University of Central Asia and Lailo Shogunbekova, Jyldyz Shigaeva, Maqsad Suriev, and Alim Saileybaev for their work on the references for this paper. Thanks also go to Roy Behnke, Cara Kerven, Daniel Maselli, Sarah Robinson, and Inam ur-Rahim for their contributions. The authors

acknowledge support from the University of Central Asia's Mountain Societies Research Centre for the publication of this article. The authors alone are responsible for the content.

## REFERENCES

- ADB [Asian Development Bank].** 2009. *Central Asian Countries Initiative for Land Management*. <http://www.adb.org/projects/CACILM/>; accessed on 26 June 2012.
- ADB [Asian Development Bank].** 2010. *Key Indicators for Asia and the Pacific 2010*. Mandaluyong City, Philippines: ADB.
- Aizen V, Aizen E, Melack J, Dozier J.** 1997. Climatic and hydrologic changes in the Tien Shan, Central Asia. *American Meteorological Society* 10: 1393–1404.
- Ajibekov A.** 2005. *Animal Husbandry in Kyrgyzstan*. Workshop paper 5. Strategies for Development and Food Security in Mountainous Areas of Central Asia. Dushanbe, Tajikistan: Inwent, Aga Khan Foundation, GTZ. [http://www.akdn.org/akf\\_rd\\_mountains\\_papers.asp](http://www.akdn.org/akf_rd_mountains_papers.asp); accessed on 24 June 2012.
- AKF [Aga Khan Foundation].** 2004. *Baseline Survey of Gorno Badakhshan Autonomous Oblast*. Mountain Societies Development Support Programme. Tajikistan. <http://www.untij.org/library>; accessed on 31 January 2012.
- AKF [Aga Khan Foundation].** 2005. *Final Survey of Rasht Valley*. Mountain Societies Development Support Programme. Tajikistan: Tajikistan Rural Poverty Reduction Project JFPR9008-TAJ. <http://www.untij.org/library>; accessed on 31 January 2012.
- AKF [Aga Khan Foundation].** 2006. *Baseline Household Survey of Alai and Chong Alay, Kyrgyzstan*. Mountain Societies Development Support Programme. Osh, Kyrgyzstan: AKF.
- Akramov KT, Omuraliev N.** 2009. *Institutional Change, Rural Services, and Agricultural Performance in Kyrgyzstan*. Discussion Paper 00904. Washington DC: International Food Policy Research Institute.
- Behnke RH, Scoones I.** 1993. Rethinking range ecology: Implications for rangeland management in Africa. In: Behnke RH, Scoones I, Kerven C, editors. *Range Ecology at Disequilibrium*. London, United Kingdom: Overseas Development Institute, International Institute for Environment and Development, and Commonwealth Secretariat, pp 1–30.
- Bimüller C, Samimi C, Zech M, Vanselow KA, Bäuml R, Dotter D.** 2010. The influence of grazing on high mountain soils in the Eastern Pamirs/Tajikistan. *Geophysical Research Abstracts* 12, EGU2010-10714-1, EGU General Assembly:10714.
- Briske DD, Fuhlendorf SD, Smeins FE.** 2005. State-and-transition models, thresholds, and rangeland health: A synthesis of ecological concepts and perspectives. *Rangeland Ecology and Management* 58(1):1–10.
- CARNET [Environment and Sustainable Development in Central Asia and Russia].** 2005. *Habitat Degradation and Loss*. <http://www.caresd.net/site.html?en=1&id=815>; accessed on 26 June 2012.
- Christensen JH, Hewitson B, Busuioac A, Chen A, Gao X, Held I, Jones R, Kolli RK, Kwon W-T, Laprise R, Magaña Rueda V, Mearns L, Menéndez CG, Räisänen J, Rinke A, Sarr A, Whetton P.** 2007. Regional climate projections. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL, editors. *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom: Cambridge University Press, pp 847–940.
- Conservation International.** 2012. *Mountains of Central Asia*. [http://www.conservation.org/where/priority\\_areas/hotspots/europe\\_central\\_asia/Mountains-of-Central-Asia/Pages/default.aspx](http://www.conservation.org/where/priority_areas/hotspots/europe_central_asia/Mountains-of-Central-Asia/Pages/default.aspx); accessed on 26 June 2012.
- Coughenour M, Behnke R, Lomas J, Price K.** 2008. Forage distributions, range condition, and the importance of pastoral movement in Central Asia: A remote sensing study. In: Behnke RH, editor. *The Socio-Economic Causes and Consequences of Desertification in Central Asia*, Springer, Dordrecht, pp 45–80.
- Cruz RV, Harasawa H, Lal M, Wu S, Anokhin Y, Punsalma B, Honda Y, Jafari M, Li C, Huu Ninh N.** 2007. Asia. In: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE, editors. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom: Cambridge University Press, pp 469–506.
- Domeisen M.** 2002. *Marginalized by the Impacts of Transformation: A Study of Post-Soviet Livestock Breeding in the High Mountains of Eastern Pamirs* [Diploma thesis]. Bern, Switzerland: University of Bern.
- Eggenberger S.** 2011. *Effects of Labour Migration on Rural Livelihoods in Tajikistan. With a Special Regard on the Interlinkages to Agricultural Land Use* [Diploma thesis]. Zurich, Switzerland: Department of Geography, University of Zurich. [http://www.nccr-central-asia.org/MSCTHESIS\\_EGGENBERGERS.pdf](http://www.nccr-central-asia.org/MSCTHESIS_EGGENBERGERS.pdf); accessed on 31 January 2012.
- Eriksson C.** 2006. *Changing Land Rights, Changing Land Use: Privatisation Drives Landscape Change in Post-Soviet Kyrgyzstan*. Minor Field Studies [Master's thesis]. Uppsala, Sweden: Swedish University of Agricultural Sciences.
- Food and Agriculture Organisation [FAO].** 2011. *FAOStats: Statistics page of the Food and Agriculture Organisation (FAO)*. Rome, Italy: FAO. <http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor>; accessed 19 and 23 May 2011.
- Food and Agriculture Organisation [FAO].** 2012. *FAOStats: Statistics page of the Food and Agriculture Organisation (FAO)*. Rome, Italy: FAO. <http://faostat.fao.org/site/377/DesktopDefault.aspx?PageID=377#ancor>; accessed 28 February 2012.
- Farrington, J.** 2005. De-development in Eastern Kyrgyzstan and persistence of semi-nomadic livestock herding. *Nomadic Peoples* 9(1):171–197.
- Fitzherbert A.** 2000. *Country Pasture/Forage Resource Profile: Kyrgyzstan*. FAO Working Paper. <http://www.fao.org/ag/agp/agpc/doc/Counprof/Kyrgystan/kyrgi.htm#1>; accessed on 26 June 2012.
- Giese E, Mossig I, Rybski D, Bunde A.** 2007. Long-term analysis of air temperature trends in Central Asia. *Erdkunde* 61:186–202.
- GoKR [Government of the Kyrgyz Republic].** 2009. *Second National Communication of the Kyrgyz Republic to the UN Framework Convention on Climate Change*. Bishkek, Kyrgyzstan: GoKR.
- GoTJ [Government of Tajikistan].** 2008. *Second National Communication of Tajikistan to the UN Framework Convention on Climate Change*. Dushanbe, Tajikistan: GoTJ.

- Hangartner J.** 2002. *Dependent on Snow and Flour: Organization of Herding Life and Socio-Economic Strategies of Kyrgyz Mobile Pastoralists in Murghab, Eastern Pamir, Tajikistan* [Master's thesis]. Bern, Switzerland: Institute of Ethnology, University of Bern.
- Harris RB.** 2010. Rangeland degradation on the Qinghai-Tibetan plateau: A review of the evidence of its magnitude and cause. *Journal of Arid Environments* 74:1–12.
- Haslinger A, Breu T, Humi H, Maselli D.** 2007. Opportunities and risks in reconciling conservation and development in a post-Soviet setting: The example of the Tajik National Park. *International Journal of Biodiversity Science and Management* 3(3):157–169.
- Ives J.** 2001. Highland-lowland interactive systems: Draft document for FAO-FORC/IYM 2002. <http://www.fao.org/forestry/12408-0c3cc6fd0b741ceb40769c2130c27f99.pdf>; accessed on 15 February 2012.
- Jacquesson S.** 2010. Reforming pastoral land use in Kyrgyzstan: From clan and custom to self-government and tradition. *Central Asian Survey* 29(1):103–118.
- Ji CY.** 2008. *ADB Land Degradation in Central Asia. Draft Report Prepared for Asian Development Bank*. ADB TA 6356-REG: Central Asian Countries Initiative for Land Management Multicountry. Almaty, Kazakhstan: Asian Development Bank.
- Jones KD.** 2003. Land privatization and conflict in Central Asia: Is Kyrgyzstan a model? In: Burghart D, Sabonis-Helf T, editors. *In the Tracks of Tamerlane: Central Asia's Paths to the 21st Century*. Washington DC: Center for Technology and National Security Policy, pp 259–273.
- Jones L, Black R, Skeldon R.** 2007. *Migration and Poverty Reduction in Tajikistan*. Working Paper C11. University of Sussex, Brighton: Development Research Centre on Migration, Globalisation and Poverty.
- Kanji N.** 2002. Trading and trade-offs: Women's livelihoods in Gorno-Badakhshan, Tajikistan. *Development in Practice* 12(2):138–152.
- Kerven C.** 2003. Agrarian reform and privatization in the wider Asian region: Comparison with Central Asia. In: Kerven, C, editor. *Prospects for Pastoralism in Kazakhstan and Turkmenistan*. London, United Kingdom: Routledge-Curzon, pp 10–26.
- Kerven C, Alimaev I, Behnke R, Davidson G, Smailov A, Temirbekov S, Wright I.** 2006. Fragmenting pastoral mobility: Changing grazing patterns in post-Soviet Kazakhstan. In: Bedunah D, McArthur E, Fernandez-Gimenez M, editors. *Rangelands of Central Asia: Transformations, Issues and Future Challenges*. Rocky Mountain Research Station Serial, RMRS-P-39 2006. Fort Collins, CO: U.S. Department of Agriculture, pp 99–110.
- Kerven C, Channon J, Behnke R.** 1996. *Planning and Policies on Extensive Livestock Development in Central Asia*. Working Paper No. 91 [With abstracts of selected works translated from Russian by Susanne Channon]. London, United Kingdom: Overseas Development Institute.
- Kerven C, McGregor BA, Toigonbaev S.** 2009. Cashmere-producing goats in Central Asia and Afghanistan. *Animal Genetic Resources Information Bulletin* 45:15–27. <http://www.fao.org/docrep/012/i1102t/i1102t00.htm>; accessed on 15 February 2012.
- Kerven C, Shanbaev K, Alimaev I, Smailov A, Smailov K.** 2008. Livestock mobility and degradation in Kazakhstan's semi-arid rangelands: Scale of livestock mobility. In: Behnke R, editor. *The Socio-Economic Causes and Consequences of Desertification in Central Asia*. Dordrecht, the Netherlands: Springer, pp 113–140.
- Kerven C, Steimann B, Ashley A, Dear C, ur-Rahim I.** 2011. *Pastoralism and Farming in Central Asia's Mountains: A Research Review* [in English and Russian]. MSRC Background Paper No. 1. Bishkek, Kyrgyzstan: University of Central Asia, Mountain Societies Research Centre. [http://www.ucentralasia.org/downloads/pastoralism\\_and\\_farming\\_in\\_central\\_asia\\_mountains.pdf](http://www.ucentralasia.org/downloads/pastoralism_and_farming_in_central_asia_mountains.pdf); accessed on 15 February 2012.
- Kerven C, editor.** 2003. *Prospects for Pastoralism in Kazakhstan and Turkmenistan*. London, United Kingdom: Routledge-Curzon.
- Khukmatullo M, Breckle S-W, Breckle U.** 2005. Effects of grazing on biodiversity, productivity, and soil erosion of alpine pastures in Tajik Mountains. In: Spehn EM, Liberman M, Korner C, editors. *Land Use Change and Mountain Biodiversity*. Miami, FL: CRC Press, Taylor and Francis, pp 239–248.
- Kuehnast K, Dudwick N.** 2004. *Better a Hundred Friends Than a Hundred Rubles?* World Bank Working Paper No. 39. Washington, DC: World Bank.
- Lerman Z, Sedik D.** 2009. *Agrarian Reform in Kyrgyzstan: Achievements and the Unfinished Agenda*. Policy Studies on Rural Transition No. 2009 (1). Budapest, Hungary: FAO Regional Office for Europe and Central Asia.
- Liechti K.** 2008. *Meanings of Pastures in the Post-Soviet Context of Rural Kyrgyzstan. Negotiating Sustainable Regional Development: The Relevance of Meaningful Spaces in Times of Change* [PhD thesis]. Bern, Switzerland: Centre for Development and Environment.
- Lioubimtseva E, Henebry GM.** 2009. Climate and environmental change in arid Central Asia: Impacts, vulnerability and adaptations. *Journal of Arid Environments* 73:963–977.
- Ludi E.** 2003. Sustainable pasture management in Kyrgyzstan and Tajikistan: Development needs and recommendations. *Mountain Research and Development* 23(2):119–123.
- Ludi E.** 2004. *Management of High Pastures under Changing Socio-economic Conditions in Kyrgyzstan*. Bern, Switzerland: Centre for Development and Environment.
- Lüthi R.** 2003. *Human Influence on the Marco Polo Sheep in the Eastern Pamir* [Thesis for Institut für Natur-, Landschafts- und Umweltschutz]. Basel, Switzerland: University of Basel.
- Macours K, Swinnen JFM.** 2005. Agricultural labor adjustments in transition countries: The role of migration and impact on poverty. *Review of Agricultural Economics* 27(3):405–411.
- Mamytov AM.** 1987. Utilization and conservation of land resources of the mountains of Central Asia and southern Kazakhstan. In: Manzoor Alam S, Habeeb Kidwai A, editors. *Regional Imperatives in Utilization and Management of Resources: India and the USSR*. New Delhi, India: Concept Publishing, pp 379–427.
- Näschler L.** 2009. *Brucellosis and Mobility: The Others Matter. A Case Study on Effects of Mobility on the Vulnerability to Brucellosis of Pastoral Households in Rural Kyrgyzstan* [Master's thesis]. Zurich, Switzerland: University of Zurich.
- Olimova S, Bosc I.** 2003. *Labour Migration From Tajikistan*. Dushanbe, Tajikistan: International Organization for Migration in Cooperation with the Sharq Scientific Research Center.
- Peyrouse S.** 2009. *The Multiple Paradoxes of the Agriculture Issue in Central Asia*. EUCAM Working Paper 6. Brussels, Belgium: European Union Central Asia Monitoring.
- Pomfret R.** 2006. *The Central Asian Economies since Independence*. Princeton, United Kingdom: Princeton University Press.
- Rahim I, Maselli D.** 2008. *Baseline Study for Project on Participatory Pasture Management in Jerge Tal Watershed, Kyrgyzstan*. Bishkek, Kyrgyzstan: CAMP Alatoo and GTZ-CCD.
- Robinson S, Whitton M.** 2010. Pasture in Gorno-Badakhshan, Tajikistan: Common resource or private property? *Pastoralism—Research, Policy and Practice* 1(2):198–217.
- Ronsijn W.** 2006. *Coping during Transition in Rural Areas. The Case of Post-Soviet Southern Kyrgyzstan*. Conflict Research Group Working Paper 4. Ghent, Belgium: Ghent University. <https://biblio.ugent.be/input/download?func=downloadFile&recordId=348106&fileId=919148>; accessed on 24 June 2012.
- Rowe WC.** 2010. Agrarian adaptations in Tajikistan: Land reform, water and law. *Central Asian Survey* 29(2):189–204.
- Russian Nature.** 2011. *Biomes and Regions of Northern Eurasia*. Russian Nature. [http://www.rusnature.info/reg/16\\_5.htm](http://www.rusnature.info/reg/16_5.htm); accessed 19 May 2011.
- Sabates-Wheeler R.** 2007. Safety in small numbers: Local strategies for survival and growth in Romania and the Kyrgyz Republic. *Journal of Development Studies* 43(8):1423–1447.
- Savitskaya D.** 2010. Statistical picture of climate changes in Central Asia: Temperature, precipitation, and river flow. International Environmental Modelling and Software Society (iEMSS) In: Swayne DA, Wanhong Yang, Voinov AA, Rizzoli A, Filatova T, editors. *International Congress on Environmental Modelling and Software Modelling for Environment's Sake*. Fifth Biennial Meeting, Ottawa, Canada. <http://www.iemss.org/iemss2010/index.php?n=Main.Proceedings>; accessed on 10 February 2012.
- Schillhorn van Veen TW.** 1995. *The Kyrgyz Sheep Herders at a Crossroads*. Pastoral Development Network Series Paper 38d. London, United Kingdom: Overseas Development Institute. <http://www.odi.org.uk/pdn/papers/index1.html>; accessed on 10 February 2012.
- Schmidt M, Sagynbekova L.** 2008. Migration past and present: Changing patterns in Kyrgyzstan. *Central Asian Survey* 27(2):111–127.
- Schoch N.** 2008. *Migration and Livestock Farming? Completing or Complementary Livelihood Strategies. A Case Study of Ylailatala, Kyrgyzstan* [Master's thesis]. Zurich, Switzerland: University of Zurich.
- Schoch N, Steimann B, Thieme S.** 2010. Migration and animal husbandry: Competing or complementary livelihood strategies. Evidence from Kyrgyzstan. *Natural Resources Forum* 34(3):211–221.
- Sedik D.** 2009. *The Feed-Livestock Nexus in Tajikistan: Livestock Development Policy in Transition*. Policy Studies on Rural Transition. Budapest, Hungary: FAO Regional Office for Europe and Central Asia.
- Steimann B.** 2011. *Making a Living in Uncertainty: Agro-pastoral Livelihoods and Institutional Transformations in Post-socialist Rural Kyrgyzstan*. Human Geography Series 26. Bishkek, Kyrgyzstan: University of Zurich.
- Tebaldi C, Hayhoe K, Arblaster J, Meehl G.** 2006. Going to the extremes: An intercomparison of model-simulated historical and future changes in extreme events. *Climate Change* 79:185–211.
- Thieme S.** 2008. Living in transition: How Kyrgyz women juggle their different roles in a multi-local setting. *Gender, Technology and Development* 12(3):325–345.



**Undeland A.** 2005. *Kyrgyz Republic: Livestock Sector Review—Embracing New Challenges*. Europe and Central Asia Region, Environmentally and Socially Sustainable Development. Washington, DC: World Bank.

**UNDP [United Nations Development Programme].** 2007. *Kyrgyzstan: Environment and Natural Resources for Sustainable Development*. Bishkek, Kyrgyzstan: UNDP. <http://www.caresd.net/site.html?en=1&id=3453>; accessed on 10 February 2012.

**UNDP and GEF [United Nations Development Programme and Global Environmental Facility].** 2008. Multi-country capacity building project supports five Central Asian countries to halt land degradation. [http://www.undp.kz/projects/start.html?search\\_url=1&n0\\_filter=1&n0\\_filtervalue\[\]=17&url=1&n2\\_filter=1&n2\\_filtervalue\[\]=20](http://www.undp.kz/projects/start.html?search_url=1&n0_filter=1&n0_filtervalue[]=17&url=1&n2_filter=1&n2_filtervalue[]=20); accessed on 24 March 2012.

**UNEP [United Nations Environment Programme].** 2011. Maps and graphics, Environmental Knowledge for Change. GRID-Arendal. United Nations Environment Programme. <http://maps.grida.no/index.cfm?event=searchFree&q=central+asia>; accessed on 24 March 2012.

**UNU-EHS [United Nations University Institute for Environment and Human Security].** 2012. PALM:

Sustainable land management in the High Pamirs and Pamir-Alai Mountains. Bonn, Germany: United Nations University Institute for Environment and Human Security. <http://www.ehs.unu.edu/article/read/palm>; accessed on 26 June 2012.

**van Leeuwen C, Emeljanenkon T, Popova L.** 1994. *Nomads in Central Asia: Animal Husbandry and Culture in Transition (19th–20th century)*. Amsterdam, the Netherlands: Royal Tropical Institute.

**Vanselow KA.** 2011. *The High-mountain Pastures of the Eastern Pamirs (Tajikistan): An Evaluation of the Ecological Basis and the Pasture Potential* [PhD dissertation]. Erlangen-Nürnberg, Germany: Friedrich-Alexander-University.

**Wirz C.** 2009. *Assessing Impacts of Different Grassland Systems on Land Degradation and Conservation in Faizabad* [Master's thesis]. Faculty of Natural Sciences. Bern, Switzerland: University of Bern.

**Wolffgramm B, Shigaeva J, Nekushoeva G, Bonfoh B, Breu T, Liniger HP, Maselli D.** 2010. Kyrgyz and Tajik land use in transition: Challenges, responses and opportunities. In: Hurni H, Wiesmann U, editors. *Global Change and Sustainable Development: A Synthesis of Regional Experiences from Research Partnerships*. Perspectives of the

Swiss National Centre of Competence in Research (NCCR) North–South, University of Bern, Vol. 5. Bern, Switzerland: Geographica Bernensia, pp 241–254.

**World Bank.** 2003. Drylands management GEF project: Kazakhstan. <http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/0,contentMDK:22523458~menuPK:64282137~pagePK:41367~piPK:279616~theSitePK:40941,00.html>; accessed on 12 September 2011.

**World Bank.** 2007. Livestock sector review: Embracing the new challenges. Kyrgyz Republic. [http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/03/14/000090341\\_20070314160221/Rendered/PDF/390260KG0Lives1iew0P09028701PUBLIC1.pdf](http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/03/14/000090341_20070314160221/Rendered/PDF/390260KG0Lives1iew0P09028701PUBLIC1.pdf); accessed on 24 March 2012.

**Xinchun Z.** 2011. Pastoralism in Xinjiang: Implementing the pastoralist settlement programme to promote sustainable development of pastoralism in Xinjiang. In: Kreutzmann H, Abdulalishoev K, Lu Zhaohui, Richter J, editors. *Pastoralism and Rangeland Management in Mountain Areas in the Context of Climate and Global Change*. Feldafing, Germany: GlZ, pp 182–188.